

Remarks

Claims 1-32 were pending in the application. Claims 21, 25, and 26 are cancelled hereby. Therefore, claims 1-20, 22-24, and 27-32 remain pending in the application

Claims 11, 12, and 19 stand allowed.

A typographical error in claim 16 has been corrected.

Claims 1-8, 13, 15-18, 20-27, and 30-32 are rejected under 35 U.S.C. 102(e) as being anticipated by United States Patent No. 6,330,102 issued to Daneman et al. on December 11, 2001.

Claims 9, 10, 14, 28, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent No. 6,330,102 issued to Daneman et al. on December 11, 2001.

Each of the various rejections and objections are overcome by amendments that are made to the specification, drawing, and/or claims, as well as, or in the alternative, by various arguments that are presented.

Entry of this Amendment is proper under 37 CFR § 1.116 since the amendment: (a) places the application in condition for allowance for the reasons discussed herein; (b) does not raise any new issue requiring further search and/or consideration since the amendments amplify issues previously discussed throughout prosecution; (c) satisfies a requirement of form asserted in the previous Office Action; (d) does not present any additional claims without canceling a corresponding number of finally rejected claims; or (e) places the application in better form for appeal, should an appeal be necessary. The amendment is necessary and was not earlier presented because it is made in response to arguments raised in the final rejection. Entry of the amendment is thus respectfully requested.

Any amendments to any claim for reasons other than to distinguish such claim from known prior art are not being made with an intent to change in any way the literal scope of such claims or the range of equivalents for such claims. They are being made simply to present language that is better in conformance with the form requirements of Title 35 of the United States Code or is simply clearer and easier to understand than the originally presented language. Any amendments to any claim in order to distinguish such

claim from known prior art are being made only with an intent to change the literal scope of such claim in the most minimal way, i.e., to just avoid the prior art in a way that leaves the claim novel and not obvious in view of the cited prior art, and no equivalent of any subject matter remaining in the claim is intended to be surrendered.

Rejection Under 35 U.S.C. 102

Claims 1-8, 13, 15-18, 20-27, and 30-32 are rejected under 35 U.S.C. 102(e) as being anticipated by United States Patent No. 6,330,102 issued to Daneman et al. on December 11, 2001.

The Office Action maintains this rejection, which was originally made in the Office Action immediately preceding the current one.

The Office Action summarizes applicants' prior arguments essentially accurately, stating that applicants' primary argument is that Daneman et al. does not disclose all the limitations of the claimed invention. Specifically, Daneman et al. does not disclose that the first and second angles of reflection combine in the same direction so that the combined angle is greater than either of the first or second angle about the specified axis. This is because the various MEMS devices of Daneman et al. that are coupled by an imaging system, e.g., to form an input or an output module, rotate about mutually orthogonal axes. Thus, the rotation of the coupled MEMS devices of Daneman et al. do not combine in the same direction, so that the combined angle is greater than either of the first or second angle about a specified axis.

This having been said, the Office Action states in response that it is clear that the Daneman et al. reference provides multiple MEMS device, where each has a plurality of mirrors, each of these mirrors being able to rotate about a single axis. It is also clear that the system of FIG. 4, having two MEMS devices, each containing a plurality of mirrors capable of rotating about a single axis, would be capable of producing a combined angle of reflection greater than either the first or second angle of reflection about a specified axis.

The Office Action's conclusion is incorrect.

It is well known that rotations about each of two **orthogonal** axis, as in the Daneman et al., does not result in an a rotation around either of the axes greater than the

rotation about that axis had it not been combined with the rotation about its orthogonal companion, provided none of the angles are negative (which will be addressed further hereinbelow). This is because the rotations do not add around the same axis, as the rotations are about axes that are orthogonal. The component of rotation about one axis does not contribute in any way to the component of rotation about the other axis. Thus, the Office Action's conclusion must be incorrect.

It seems to applicants that the Office Action may be attempting to add the angles of rotations of MEMS devices that should not be combined given the language of applicants' claims. Thus, it could be that the Office Action is not taking into proper account applicants' recited limitation that the MEMS devices whose rotations are to be combined may be only those that are optically coupled together by an imaging system. Instead it appears that the Office Action believes that the rotations of any of the MEMS devices disclosed by Daneman et al. can be added together. However, doing so improperly, and overly broadly, construes the scope of applicants' claims as they now stand.

By contrast, proper application of this limitation with regard to Daneman et al. permits only those MEMS device that have an imaging system between them to have their rotations about a single axis combined. Thus, according to applicants' limitation, in Daneman et al. a) only MEMS devices 212 may be combined with MEMS device 214 via the imaging system between them as a first group, and b) only MEMS devices 222 to be combined with MEMS device 224 via the imaging system between them as a second group. It therefore follows that MEMS device 212 cannot be combined with MEMS device 222 and that MEMS device 214 cannot be combined with MEMS device 224.

Given that the mirrors of MEMS devices 212 rotate about an axis that is mutually orthogonal to the axis about which the mirrors of MEMS device 214 rotate (see Daneman et al., column 4, lines 24-25), this grouping cannot have an effective rotation about either of the axes that is greater than the rotation about any one of the axes. Similarly, given that the mirrors of MEMS devices 222 rotate about an axis that is mutually orthogonal to the axis about which the mirrors of MEMS device 224 rotate (see Daneman et al., column

4, lines 27-28), this grouping cannot have an effective rotation about either of the axes that is greater than the rotation about any one of the axes.

Therefore, in Daneman et al., there are no MEMS devices grouped by an imaging system whose angles of rotation can be combined about a single axis, as recited in applicants' claims. Therefore, applicants' claims are allowable over Daneman et al. under 35 U.S.C. 102.

The foregoing having been said, after further review of the invention, the claim language as previously presented, and Daneman et al., applicants have realized that the angles about the single axis could combine positively or negative, depending on what angle is defined to be zero. Therefore, the claims have been amended to indicate that the combined angle about the axis of interest is merely different than either of angles of the MEMS devices separately, rather than necessarily being greater, provided that neither of the mirrors is at the position considered to be zero. This is because the angle of each of the mirrors makes its contribution in an additive fashion, as the total resulting angle is the sum of both angles, so only an angle of zero for at least one of the mirrors would result in the angle being the same as for the other mirror. In all other cases, the angle would be different, the particular value being based on the magnitude and sign of the two angles being combined.

Rejection Under 35 U.S.C. 103(a)

Claims 9, 10, 14, 28, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent No. 6,330,102 issued to Daneman et al. on December 11, 2001.

This ground of rejection is for dependent claims only, and is predicated on the ability to maintain the rejection above under 35 U.S.C. 102(e) given Daneman et al. Since the rejection above under 35 U.S.C. 102(e) over Daneman et al. has been overcome, and the no additional elements are provided by Danemen et al. or suggested in the Office Action regarding the rejection under 35 U.S.C. 103(a), this ground of rejection cannot be maintained, because the rejected claims depend from independent claims which are allowable.

Therefore, claims 9, 10, 14, 28, and 29 are allowable over Daneman et al. under 35 U.S.C. 103(a).

Conclusion

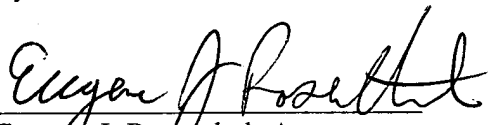
It is respectfully submitted that the Office Action's rejections have been overcome and that this application is now in condition for allowance. Reconsideration and allowance are, therefore, respectfully solicited.

If, however, the Examiner still believes that there are unresolved issues, he is invited to call applicant's attorney so that arrangements may be made to discuss and resolve any such issues.

In the event that an extension of time is required for this amendment to be considered timely, and a petition therefor does not otherwise accompany this amendment, any necessary extension of time is hereby petitioned for, and the Commissioner is authorized to charge the appropriate cost of such petition to the **Lucent Technologies Deposit Account No. 12-2325**.

Respectfully,

D. T. Neilson
R. Ryf

By 
Eugene J. Rosenthal, Attorney
Reg. No. 36,658
732-949-1857

Lucent Technologies Inc.

Date: May 21, 2003

Replacement claim 1

1 1. (Twice amended)An optical switch, comprising
2 a first micro-electro mechanical system (MEMS) device containing a first number
3 of micro mirrors tiltable about at least a first axis;
4 a second micro-electromechanical system (MEMS) device containing a second
5 number of micro mirrors tiltable about at least said first axis; and
6 a first imaging system optically coupled to said first MEMS device so as to
7 produce an image of each of said micro mirrors of said first MEMS device on a
8 corresponding micro mirror of said second MEMS device;
9 so that at least one of said micro mirrors of said first MEMS device is grouped by
10 said first imaging system with at least one of said micro mirrors of said second MEMS
11 device such that the angle of reflection from said at least one grouped micro mirror of
12 said first MEMS device and the angle of reflection from said at least one grouped micro
13 mirror of said second MEMS device combine to produce an overall effective angle about
14 said first axis for said group which is different than either the angle of reflection from
15 said at least one grouped micro mirror of said first MEMS device and the angle of
16 reflection from said at least one grouped micro mirror of said second MEMS device when
17 neither one of the angle of reflection from said at least one grouped micro mirror of said
18 first MEMS device and the angle of reflection from said at least one grouped micro
19 mirror of said second MEMS device is zero.

Unchanged claim 2

1 2. The invention as defined in claim 1 wherein said first number and said second
2 number are the same.

Unchanged claim 3

1 3. The invention as defined in claim 1 further comprising a plurality of optical
2 source coupled to supply input light to said first MEMS device.

Unchanged claim 4

1 4. The invention as defined in claim 1 further comprising a plurality of optical
2 source coupled to supply input light to said first MEMS device, wherein at least one of
3 said optical sources are one of the group consisting of an optical fiber, a laser, a light
4 emitting diode, light source, and a planar wave guide.

Unchanged claim 5

1 5. The invention as defined in claim 1 further comprising a receiver coupled to
2 receive output light from said second MEMS device.

Unchanged claim 6

1 6. The invention as defined in claim 1 further comprising a receiver coupled to
2 receive output light from said second MEMS device, each of said receiver being one of
3 the group consisting of an optical fiber, a photo detector, and a planar wave guide.

Unchanged claim 7

1 7. The invention as defined in claim 1 wherein said first imaging system
2 reproduces an angle of reflection of the light from each of said micro mirrors of said first
3 MEMS device

Unchanged claim 8

1 8. The invention as defined in claim 1 wherein said overall effective angle for
2 said group is a sum of said angle of reflection from each of said micro mirrors of said
3 group.

Unchanged claim 9

1 9. The invention as defined in claim 1 further comprising a field lens for
2 receiving light reflected by said second MEMS device.

Unchanged claim 10

1 10. The invention as defined in claim 1 further comprising a field lens through
2 which light passes prior to being incident onto said first MEMS device.

Unchanged claim 11

1 11. An optical switch, comprising
2 a first micro-electro mechanical system (MEMS) device containing a first number
3 of micro mirrors;
4 a second micro-electromechanical system (MEMS) device containing a second
5 number of micro mirrors; and
6 a first imaging system optically coupled to said first MEMS device so as to
7 produce an image of each of said micro mirrors of said first MEMS device on a
8 corresponding micro mirror of said second MEMS device; and
9 a mirror for receiving light reflected by said second MEMS device and reflecting
10 said light back toward said second MEMS device;
11 whereby at least one of said micro mirrors of said first MEMS device is grouped
12 with at least one of said micro mirrors of said second MEMS device such that the angle
13 of reflection from said at least one grouped micro mirror of said first MEMS device and
14 the angle of reflection from said at least one grouped micro mirror of said second MEMS
15 device combine to produce an overall effective angle for said group.

Unchanged claim 12

1 12. The invention as defined in claim 11 wherein said mirror is of a type selected
2 from the group of types consisting of: planar and curved.

Unchanged claim 13

1 13. The invention as defined in claim 1 wherein said first number of micro
2 mirrors and said second number of micro mirrors are the same.

Unchanged claim 14

1 14. The invention as defined in claim 1 wherein said first number of micro
2 mirrors and said second number of micro mirrors are different.

Unchanged claim 15

1 15. The invention as defined in claim 1 wherein the size of said micro mirrors of
2 said first device is the same as the size of said micro mirrors of said second device.

Replacement claim 16

1 16. (Amended) The invention as defined in claim 1 wherein the size of said micro
2 mirrors of said first device is ~~the same~~ different than the size of said micro mirrors of said
3 second device.

Unchanged claim 17

1 17. The invention as defined in claim 1 wherein said imaging system is a
2 telecentric system.

Unchanged claim 18

1 18. The invention as defined in claim 1 further comprising
2 a third micro-electromechanical system (MEMS) device containing a third
3 number of micro mirrors;
4 a fourth micro-electromechanical system (MEMS) device containing a fourth
5 number of micro mirrors; and
6 a second imaging system optically coupled to said third MEMS device so as to
7 produce an image of each of said micro mirrors of said third MEMS device on a
8 corresponding micro mirror of said fourth MEMS device;
9 whereby at least one of said micro mirrors of said third MEMS device is grouped
10 with at least one of said micro mirrors of said fourth MEMS device such that the angle of
11 reflection from said at least one grouped micro mirror of said third MEMS device and the
12 angle of reflection from said at least one grouped micro mirror of said fourth MEMS
13 device combine to produce an overall effective angle for said group of micro mirrors of
14 said third and fourth MEMS devices.

Unchanged claim 19

1 19. An optical switch, comprising
2 a first micro-electro mechanical system (MEMS) device containing a first number
3 of micro mirrors;
4 a second micro-electromechanical system (MEMS) device containing a second
5 number of micro mirrors;
6 a first imaging system optically coupled to said first MEMS device so as to
7 produce an image of each of said micro mirrors of said first MEMS device on a
8 corresponding micro mirror of said second MEMS device; and
9 a third micro-electromechanical system (MEMS) device containing a third
10 number of micro mirrors;
11 whereby at least one of said micro mirrors of said first MEMS device is grouped
12 with at least one of said micro mirrors of said second MEMS device such that the angle
13 of reflection from said at least one grouped micro mirror of said first MEMS device and
14 the angle of reflection from said at least one grouped micro mirror of said second MEMS
15 device combine to produce an overall effective angle for said group;
16 and wherein light reflected by said micro mirrors of said third MEMS device is
17 coupled to said first MEMS device.

Unchanged claim 20

1 20. The invention as defined in claim 1 further comprising:
2 a third micro-electromechanical system (MEMS) device containing a third
3 number of micro mirrors;
4 and wherein light reflected by said micro mirrors of said second MEMS device is
5 coupled to said third MEMS device.

Cancel claim 21

Unchanged claim 22

1 22. The invention as defined in claim 1 wherein said first MEMS device is
2 arranged to act as a booster.

Unchanged claim 23

1 23. The invention as defined in claim 1 wherein each of said grouped micro
2 mirrors effectively contribute different angles to said overall effective angle for said
3 group.

Unchanged claim 24

1 24. The invention as defined in claim 1 wherein one of each of said grouped
2 micro mirrors effectuates coarse tilt and the other effectuates fine control.

Cancel claims 25-26

Replacement claim 27

1 27. (Twice amended) A method for operating an optical switch including a first
2 micro-electromechanical system (MEMS) device containing a first number of micro
3 mirrors tiltable about at least a first axis, a second micro-electromechanical system
4 (MEMS) device containing a second number of micro mirrors tiltable about at least said
5 first axis, the method comprising the step of:
6 imaging said first optical MEMS device onto said second optical MEMS device
7 so that the angle of reflection from at least one micro mirror of said first optical MEMS
8 device and the angle of reflection from at least one micro mirror of said second MEMS
9 device combine to produce an overall effective angle about at least said first axis when
10 considering said least one micro mirror of said first optical MEMS device and said at
11 least one micro mirror of said second MEMS device as a group, said overall effective
12 angle being different than either the angle of reflection from said at least one grouped
13 micro mirror of said first MEMS device and the angle of reflection from said at least one
14 grouped micro mirror of said second MEMS device when neither one of the angle of
15 reflection from said at least one micro mirror of said first MEMS device and the angle of
16 reflection from said at least one micro mirror of said second MEMS device that are being
17 combined is zero.

Unchanged claim 28

1 28. The invention as defined in claim 27 further comprising the step of passing
2 light from said second optical MEMS device through a field lens.

Unchanged claim 29

1 29. The invention as defined in claim 27 further comprising the step of receiving
2 light from a field lens at said first optical MEMS device.

Unchanged claim 30

1 30. The invention as defined in claim 27 further comprising the step of coupling
2 light passed from a fiber at said first optical MEMS device.

Unchanged claim 31

1 31. The invention as defined in claim 27 further comprising the step of coupling
2 light from said second optical MEMS device to a fiber.

Replacement claim 32

1 32. (Twice amended) An optical switch, comprising
2 a first micro reflective means mounted on a first micro-electromechanical system
3 (MEMS) means tiltable about at least a first axis;
4 a second micro reflective means mounted on a second micro-electromechanical
5 system (MEMS) means tiltable about at least said first axis;
6 a first imaging means optically arranged to produce an image of said first micro
7 reflective means at said second micro reflective means such that the angle of reflection of
8 said first micro reflective means and the angle of reflection from said second micro
9 reflective means combine about said first axis to produce an overall effective reflective
10 angle that is different than either the angle of reflection of said first micro reflective
11 means and the angle of reflection from said at least second micro reflective means when
12 neither one of the angle of reflection from said first micro reflective means and the angle
13 of reflection from said second micro reflective means is zero.